LOCK ON N°19

AIRCRAFT PHOTO FILE

762

Mikoyan MIG 29 A/C FULCRUM

Zoltán BUZA

edited by Willy PEETERS

VP

the world in scale

MIG 29 C
31st Gw IAP
Soviet VVS, Falkenberg AB

VP
the world in scale

Front cover: "Tiger-tailed" Czechoslovakian MIG-29A, a/c 4012 in standard dark green (FS 34079)/ light green (FS 34227)/ dark brown (FS 30045)/ light brown (FS 30227)upper surfaces and light grey (FS 26373) undersides. Dielectric panels are medium grey (FS 26187). This aircraft belongs to 11 Stihaci Letecky Pluk "Invazni",1. Letka (N°11 Fighter Interceptor Regiment, 1st Squadron) at Zatec in Bohemia.

Title Page: MIG-29C ac/28105 "29" of the 31st GwIAP, Soviet Air Force (VVS) normally based at Falkenberg (former East Germany) but photographed at Grossenheim airfield. The MIG-29 (NATO codename "Fulcrum") is known to the Soviets as Type 9.13. (Photo Jan-Toine van HOOFT)

Page 3 : Ground crew installing bright-colored tow bar to the nose wheel strut of multicolored MIG "29". Various Soviet standard greys are used for this scheme resembling the following Federal Standard colors, F.S. 36375 & F.S. 35237 mixed for upper fuselage and wing area and F.S. 36375 light grey for the lower fuselage and wing areas. Scheme application varies from one aircraft to another, analog to jets in the west.
(Photo Jan-Toine van HOOFT)

MIG-29A SPECIFICATIONS

Length (overall)	17.32m	Thrust to weight ratio (air-ground)	1:0.96
Fuselage length	14.87m	Maximum take off weight	184.8kN
Wingspan	11.36m	Maximum speed	2450km/h
Tailplane span	7.78m	Maximum speed (sea level)	1500km/h
Height	4.73m	Maximum rate of climb	330m/s
Wheeltrack	3.10m	Range	1430km
Wheelbase	3.67m	Range at sea level	710km
Wing area	38m2	Ferry range	2100km
Maximum thrust	136kN	Service ceiling	18000m
Empty weight	109kN	Ground roll	240-250m
Take off weight		Ground roll /wo augmentor	650m
(2xR-27R-1 + 4xR-60)	153,6kN	Take off speed (clean)	220km/h
Thrust to weight ratio (air-air)	1:1.06	Maximum load factor above 0.85M	+7/-1.5g
Take off weight		Maximum load factor below 0.85M	9.5/-3g
(4 KMGU-2)	169,8kN		

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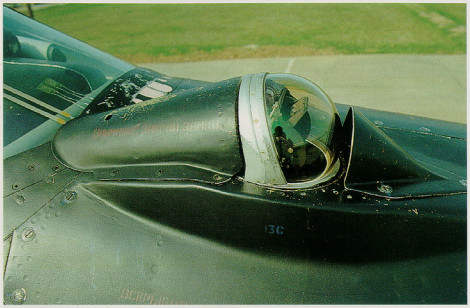
Further use was made of slides sent in by Jan-Toine van HOOFT of Holland, Nico DE BOECK and Roger MEES of Belgium for which we owe a sincere thanks.
Dr Zoltán BUZA & Willy PEETERS

Readers are invited to send in slides and/or clear color photographs on military subjects which may be used in future LOCK ON publications. Additional information on military aircraft of any kind is also welcomed. Material used will be paid for upon publication and unused material will be returned upon request. Original slides and photographs will be handled with extreme care.
Clearly state name and address when sending in your material.

INTRODUCTION

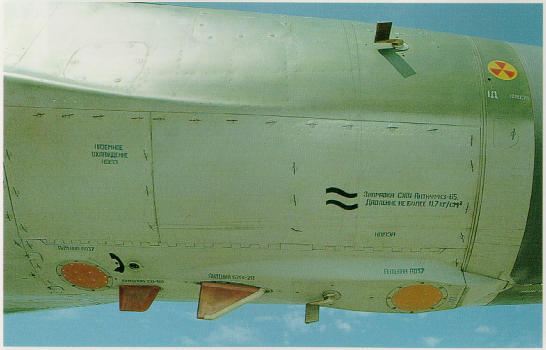
Who does not recall the spectacular, but unintentional, display of Anatoly KVOTCHUR who bailed out of his MIG-29A seconds before it hit the ground at Le Bourget, France, ending its career as a demonstration aircraft. A starboard engine failure at an altitude of only 500 ft (some 165m) and at a speed of just 112 mph (180 km/h) made the aircraft roll to starboard, subsequently descending almost vertically in a nose down attitude, resulting in total destruction. Only six months earlier the same aircraft stunned spectators at the Farnborough Airshow when it performed unprecedented tail-slide maneuvers at amazingly low altitudes. This was, of course, made possible by two powerful Isotov RD-33 turbofans (18,300 lb /8,301 kg thrust each) and the ventral auxiliary air intakes. Initial development of the MIG-29A (NATO codename Fulcrum) was started in mid-1975 and the first prototype of the F-16 counteraircraft took off from the Ramenskoye flight test center some two years later. Some eleven test aircraft were built of which a number were lost due to engine failures (mostly compressor stalls). Full-scale production of the fighter began mid-1982 with the first operational aircraft to equip VVS squadrons the following year. Next to the single-seat fighter, a MIG-29UB training variant was developed with two cockpits in tandem requiring an overall length increase of some 3,9 in (10cm). Combat capability of these aircraft remains restricted.
An updated version, the MIG-29C, distinguishable by the enlarged dorsal spine (or humpback) housing additional avionics, is gradually replacing the A variant.
A MIG-29A was modified for carrier trials, equipped with a strengthened landing gear, folding wings, tailhook and more carrier-compatible systems; and completed a number of succesful touch and go's on the Soviet aircraft carrier TBILISI.
The development of more updated versions is taking place with the first of these aircraft being displayed recently.

(Below) A fairing mounted in front of the windscreen (slightly offset to the right) houses the KOLS, an infrared search- and tracking sensor/laser rangefinder combination (IRST/LR), partially protected at the front with a half-cone shaped cover, only installed when the unit is not intended to be used. With cover installed, effective range is 15 km.



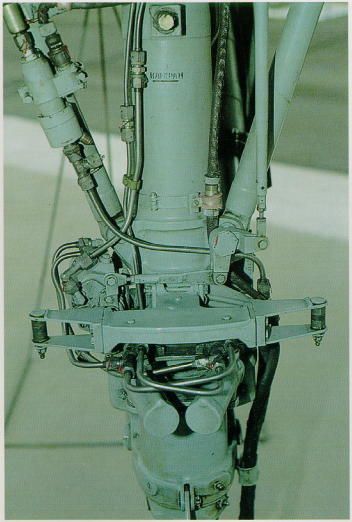
(Top and left) The MIG-29 features a conventional, single-piece nose cone with large pitot tube (with vortex generators on the sides). Typical downward inclination of the nose cone (14°) characterizes the MIG-29. Right of the black anti-glare panel (which stops short of the nose cone) is an auxiliary pitot tube angled downward. Note the radiation hazard sign just aft of the nose cone.

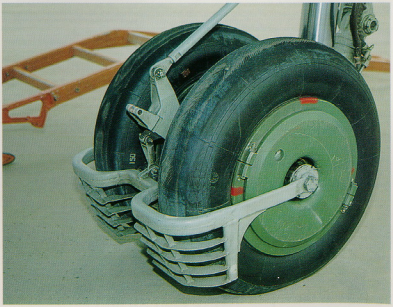
Two dielectric fairings in the wing root serve radar homing and radar warning antenna systems. The most forward one is serving the onboard SO-69 transponder. Nearly all panel screws are marked with aligning stripes. Note the ejection seat warning sign below the canopy sill.



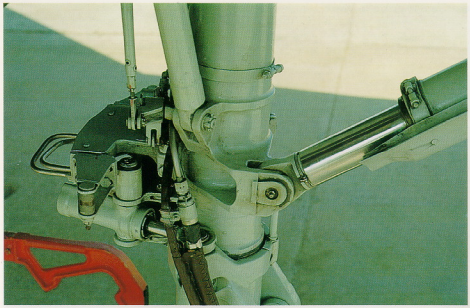
Radar altimeter dielectric panel, yaw vane and Parol IFF antenna are major components of the ventral nose fairing. The angle of attack vane (AOA) can be seen at the top of the picture.

Obviously designed for rough terrain landings (or bad landings on concrete runways) the single strut features a dual wheel assembly with a single hydraulic retracting ram connected to the right side of the strut (and NOT on the centerline). Note the concave shape of the ram housing roof.



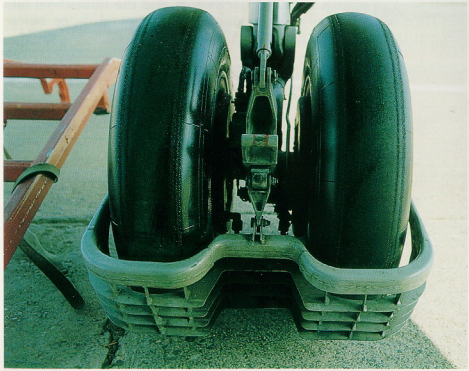


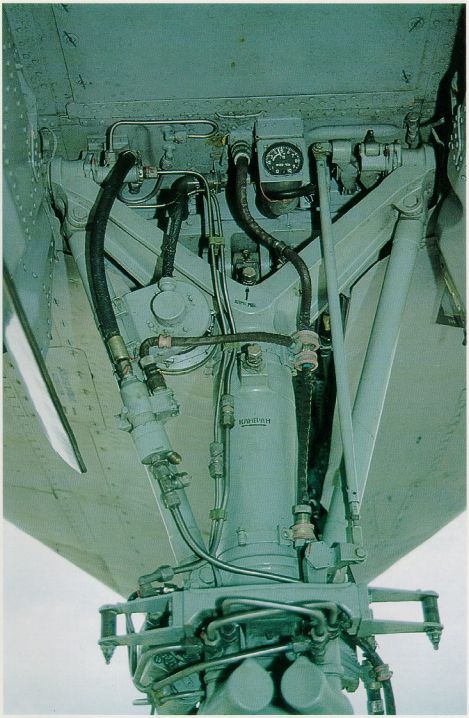
Noteworthy in this view is the single landing light mounted to the left upper side of the strut and both anti-sway struts. A small strut aft of the leg serves mudguard movement according to gear position.



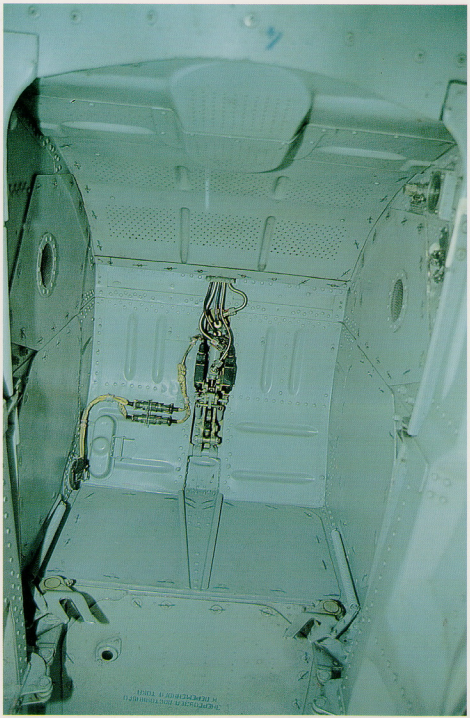
Nose steering unit from the right side and close view of the retracting strut/leg connection. The device on top of the steering unit holds two rollers which mechanically close the main doors. Note the heavy hydraulic feed lines and the boarding ladder detail in the background.

The mudguard, which is actually a deflection device, pivots on the wheel axis outside of the gear and position is controlled by a single strut on the centerline. Note the slick appearance of the rubber tires which are 570mm x 140mm in dimension.



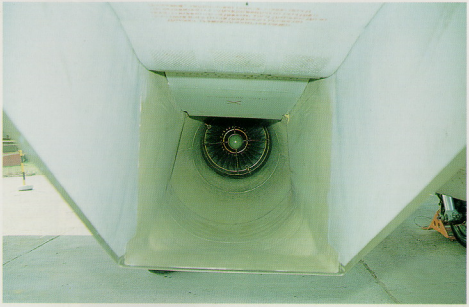


A Y-shaped yoke assembly connects the landing gear strut with the fuselage structure. Hydraulic feed lines and electrical wiring runs from the shallow forward part of the gear housing. A hydraulic pressure monitoring dial is attached to the front bulkhead.
Note steering unit detail and door closing rollers at the bottom of the photo.

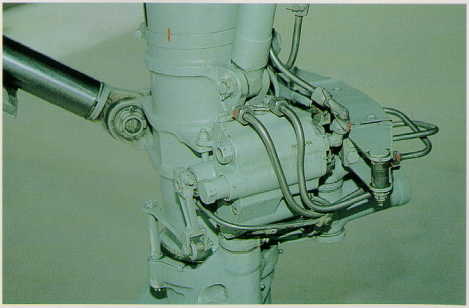


The large nose gear wheel bay looking up and forward. The shallow front part of the bay can be seen at the bottom of the picture. Again note the aligning marks on the screws holding the bay roof in place. This panel can be removed to give access to various systems requiring regular maintenance. The locking device in the center of the bay roof is the receiving end of the mudguard strut. Also noteworthy are the bay side walls.

(Right) Left side detail of the steering unit.



The large intake tunnel of the right side featuring the Isotov RD-33 turbine blades at the end. The FOD doors, which close as the engine is started is still in the up position. Doors reopen at 200 km/h when the stick is pulled backwards and the nosewheel lifts off. They automatically close again when airspeed drops below 200 km/h. Door surface detail is shown on page 24.

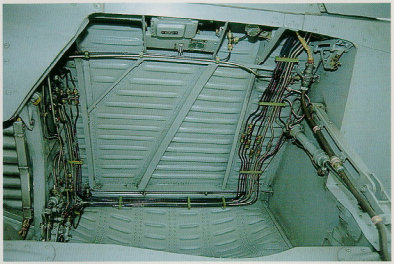


(Photo Jan-Toine van HOOFT)

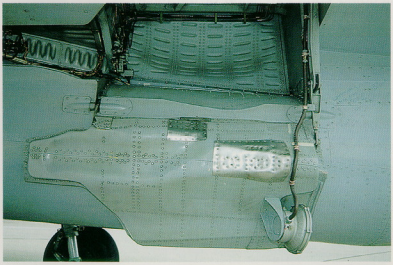
(Top) Overall right side wing area and leading edge extension of the MIG-29C in Soviet service. The "C" model can be distinguished by the enlarged "humpted" dorsal spine (housing additional avionics) and the deletion of the blister on the lower part of the latter, just above the auxiliary intake slots.
Crewmembers' communication devices can be seen attached to the nose.
Apparant in this view is the shape of the canopy and the dorsal spine ARK aerials (blade and panel).

(Right) View on the mid-fuselage and wing area showing the position and forward angle of the main gear strut with the hydraulic ram attached to the rear of the main gear strut. Also clear is the position of the below-wing national insignia and the outboard pylon holding no weapons.

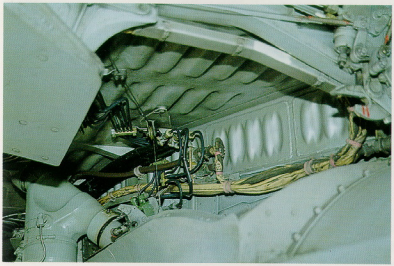
The right side main gear door looking aft with the forward mounted retracting arm and actuating ram. The door also serves as a mounting platform for the landing light, served by an oversized electrical feed line.



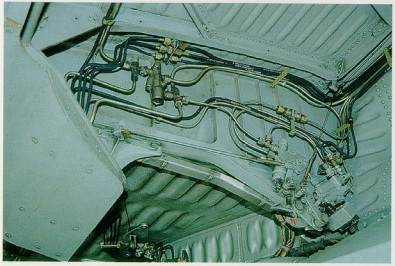
The main wheel bay roof features embossed panels and structural strengtheners, surrounded by feed/ hydraulic lines mainly serving gear and gear door retraction. The small pressure gauge and box counts engine operation time.



A very unorthodox main gear door design, seemingly hand-shaped to clear strut and main wheel. It is hinged at both ends with hinge points of similar crude design.

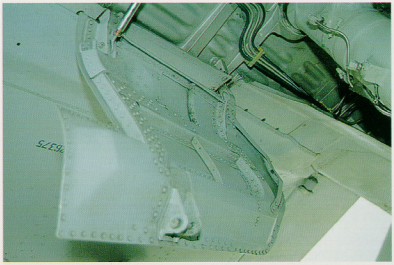


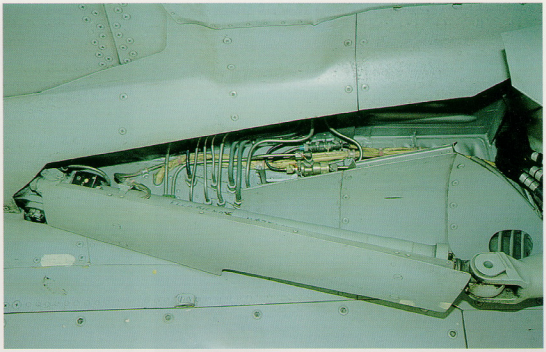
Angled main gear hinge point and shallow leg housing area. The piping of different systems can be recognized as follows: black- pressurized air, yellow- fuel system, grey/bare metal- hydraulics, blue- oxygen, brown- oil system.

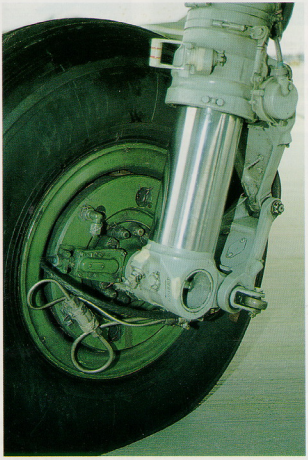


A view on the center spar of the main gear well also serving as a platform to mount feed lines and pressure control devices.

The main gear strut and door from behind revealing main gear detail and the pushbeam connecting strut protruding from the main leg. Note the shape of the outboard wheel well cover.



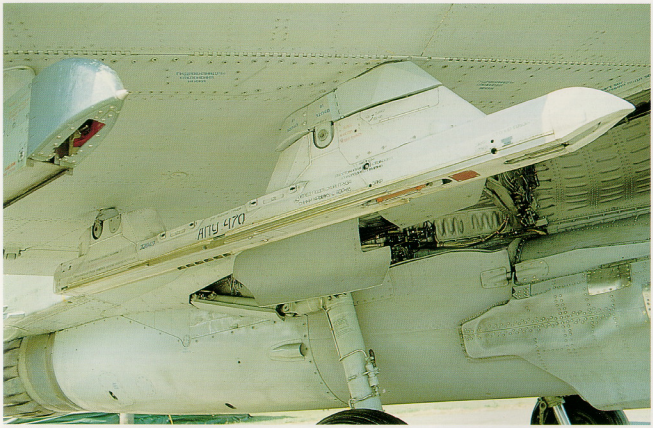




(Top left) Inside detail of the same outboard door looking aft. Note locking clamp at the bottom edge.

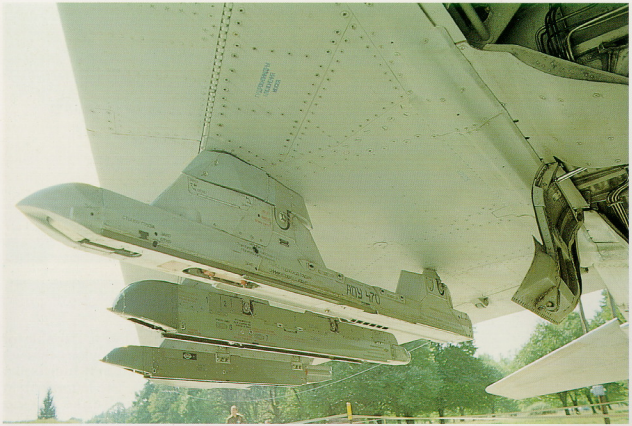
(Top right) The hydraulic pushbeam is stowed in a shallow housing featuring more feed lines. The rod cover door is attached to the rod itself and does not cover the rear pivoting point when raised.

(Bottom left & right) KT-150 main wheel disc and tire detail. Low pressure tires (sized 840mm x 290mm) are optimized for rough field operations (actually never tried in practice). Inside detail shot reveals scissor linkage at the rear and braking fluid lines for the multiple disc brakes and anti-skid system.

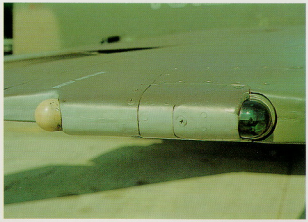


The inboard wing pylon is capable of holding missile launcher pylons (shown here) or 800 liter external fuel tanks (with heavier pylons). The latter remain attached to the fuel tanks during removal and transport.

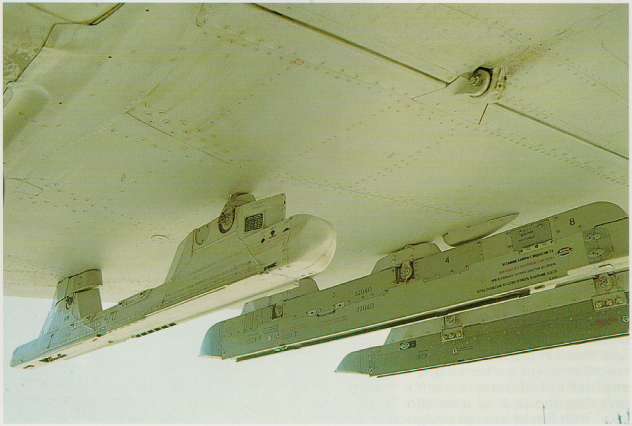
Both outboard pylons feature missile launch rails which can be compared with those in the west. However, missile rail attachment to the wing is of a less sophisticated nature, once again revealing the lack of a certain "know-how" with Soviet aircraft designers.



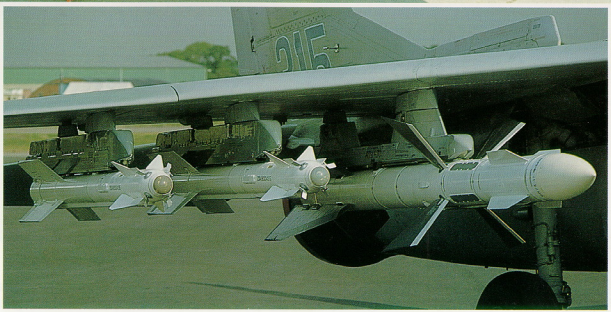
All three pylons viewed from inboard the right wing showing different shapes and sizes as well as launch rail detail at the bottom. The meaning of the two upper sub-pylons (instead of a single-piece main pylon) is not clear.



Another example of diverging aerodynamic rules is this crude SPO-15LM RWR radar warning antenna annex navigation light fairing on the outer edge of the wing. Soviet designed aircraft often look like being a basic design to which they added some 60 per cent of "things which we initially forgot to include", enhancing the idea of being multi-bureau designs.



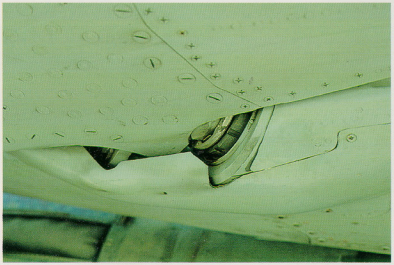
Interesting view of the underwing pylons from behind. Note the fairing aft of the rear subpylon on the middle missile launcher assembly.
Air-to-air missile armament consists of two R-27R-1 semi-active radar homing or R-27T infra-red homing missiles on APU-470 launchers, up to six R-73E IR homing missiles on APU-73-1D launchers or R-60MK IR homing small dogfight missiles on APU-60-1DB1 launchers. The usual armament for air-superiority missions is two R-27R-1 missiles on the inboard stations, two R-73 missiles on the center stations and two R-60MK missiles on the outboard stations.



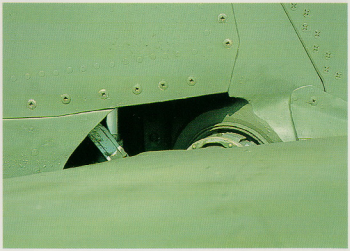
Overall view of the hydraulically actuated flap and aileron with hinges and actuators. Note the different angles of both control surfaces occuring when the aircraft is parked. Interesting detail is the rear of the wheel well fairing tapering into the aft empannage.
The photo at right illustrates a typical weapon configuration with two (inert) AA-11 "Archer" 's on the outboard pylons and a single (inert) AA-10 "Alamo" on the inboard missile launch rail assembly.

(Photo by Roger MEES)

Large vertical tail surfaces with forward bottom fairings, wide chord honeycomb rudders and dielectric panels on top. The A-323 (ILS) aerial for short-range radio navigation is located just below the colorful squadron color band. Both tails also reveal a difference in camouflage application and national insignia position within the same unit. Strange is the semi-glossy appearance of the tailcode "7501" on the matt tail surface.

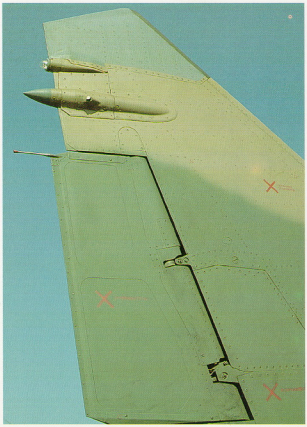


The single-piece stabilators have a single pivoting point and are hydraulically operated. A bulged fairing is covering the pivoting point at the bottom.

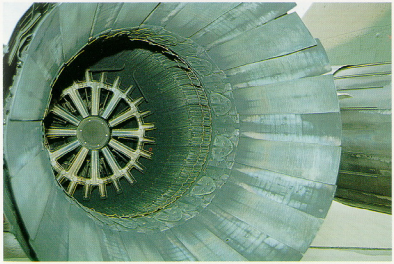


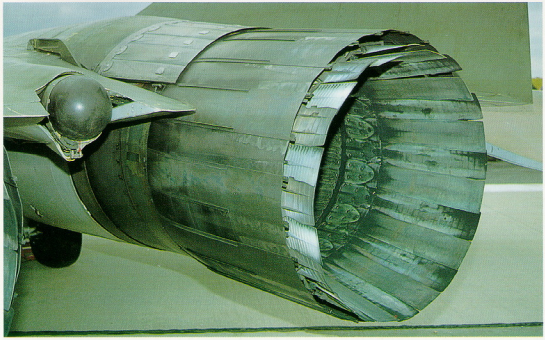
The same pivoting point, this time from above but without fairing. Instead, part of the lower tail surface is cut to clear the "roller-bearing".

To reduce speed while maneuvering, the MIG-29 has a small, hydraulically operated, split-surface airbrake between the exhaust nozzles. Centrally located and sandwiched between upper and lower airbrake half is the brake chute cannister (hinged at the bottom). The top half of the airbrake is square-edged at the rear and fits the slotted lower half. Upward deflection is 56°, downward 60°.



Inside of the left vertical tailplane with navigation light (top), SO-69 aerial with SPO-15LM (RWR) aerial incorporated (both sides of left tail).





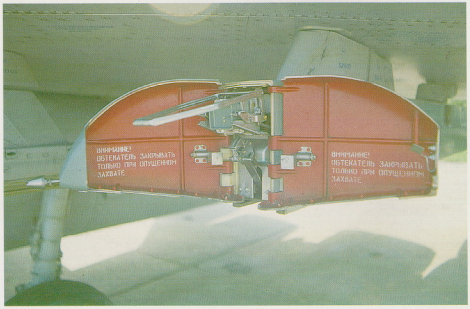
Two photos of the exhaust nozzle area of the Isotov RD-33 engine with the afterburner spray ring deep inside the exhaust tunnel. Exact exhaust nozzle operation is unclear. Note the 11 lamelae on top.

MIG 29A Fulcrum
11 Stíhací Letecký Pluk
Czechoslovakian Air Force
(Photo by Dr Zoltán BUZA)

VERLINDEN PUBLICATIONS

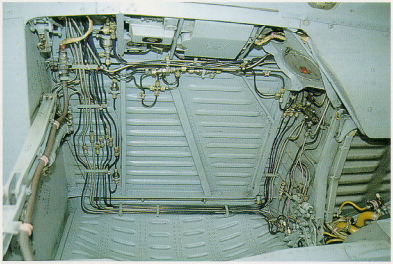
7501

The tail area of "7501" from the left with colorful markings on the inside of the right vertical tailplane. Two ram air intake probes can be distinguished just in front of the tailcode. Note the mirror image of the national insignia (compare with page 16).

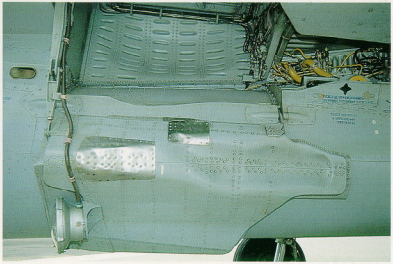


The split front of the middle pylon painted bright red and bearing inscriptions in Cyrillic.

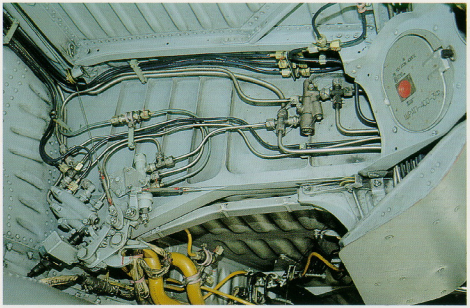
Left main gear strut and main wheel, a mirror image of the right side landing gear area.



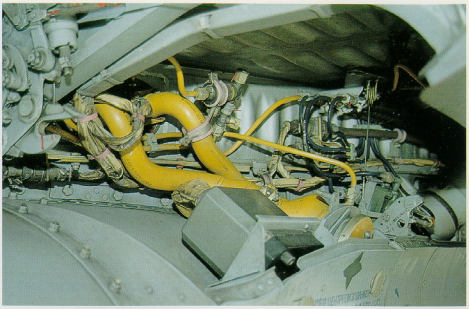
Left main gear well only differs in detail from the right side well as described on page 10 & 11, mainly in components attached to the outside upper wall. Wiring is almost identical.



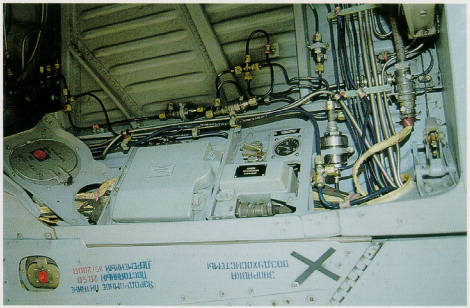
No differences here with a second landing light and reenforcement plates to the gear door inside surfaces.



Left side main center spar which is also a structural strengthener connecting the wing to the main fuselage. Like in the right main wheel well some system connector- and by-pass units are attached to it. At right is the ShRAP-400-3P external power receptacle.

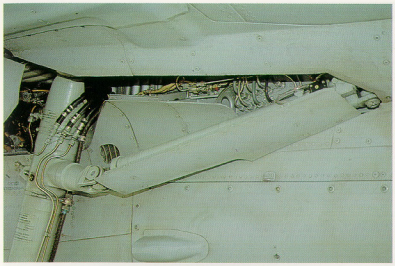


A small panel at the bottom of the well mid section (which surrounds the left engine) covers the single-point refueling hook-up with replenishment control panel where a volume of 50-75-100-110% can be selected. The MIG-29 can carry 4300 l of T-1, TS-1 or PL-6 fuel internally. The 110% setting includes external fuel tank replenishment. The downward position of the refueling receptacle gives clearance to the main gear strut.



The outboard wheel well bulkhead (at the wing root) is a mounting platform for the TESTER system control boxes. Forward is to the right.

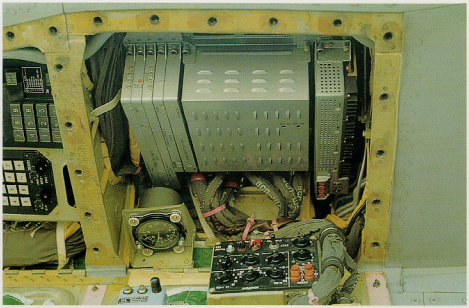
The same area more aft, completely showing the small panel with refueling markings. The refueling hook-up is designed to receive the standard NATO fuel hoses.



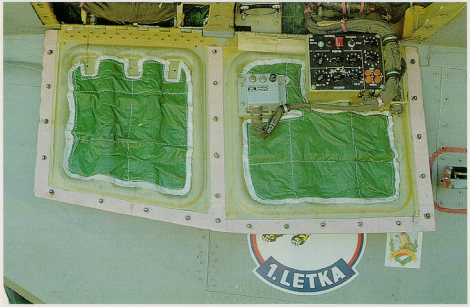
A complex wing root fairing clearly illustrates design shortcomings and last-minute updating of the outer surfaces.

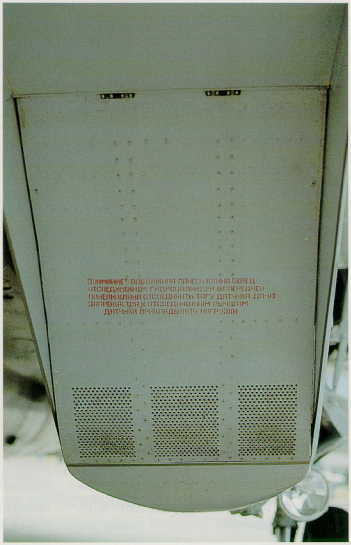
Inside detail of the left main wheel hub with scissor linkage and hydraulic pressure hoses for the brakes.

Ground crewmember in typical outfit carrying communications equipment, about to unscrew some panels in the wingroot extension with an oversize screwdriver. Note the N°1 SQN badge on the intake.

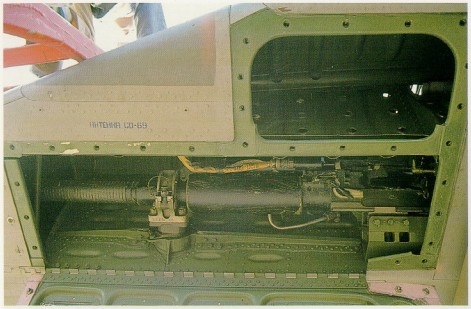


Inside panel detail revealed. This unit serves the A-323 navigation and semi-automatic landing system. Necessary data can be fed into the system by the pushbutton device in the center. The rear part of the bay is taken by the SPO-15LM radar warning receiver box which holds six pre-set hostile radar types (memory cards) for each mission.

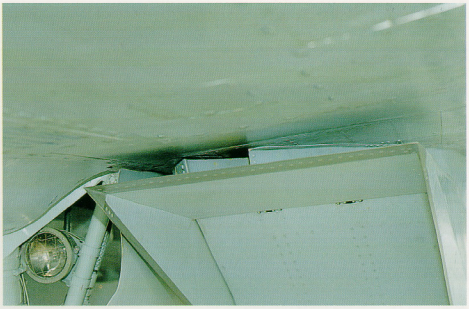




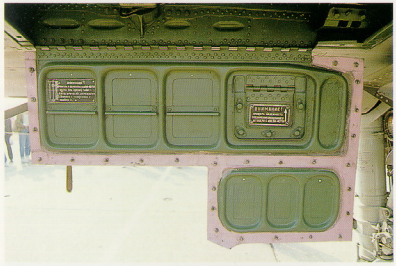
(Right) A smart idea is the installation of pivoting FOD screens in the large air intakes which are lowered during start-up and taxi procedures. It allows ground crew to move freely about the nose area without the imminent danger of disappearing through the intake tunnels. These doors automatically open for inspection after engine shutdown.



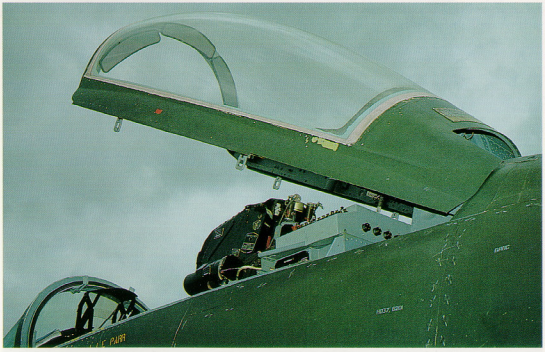
The gun bay holds a single-barrel, 30mm GSh-301 cannon w/150 rounds, capable of firing 1800 rounds per minute. Exceptional accuracy of the gun is obtained through infra-red angle-tracking and laser ranging weapon control system.



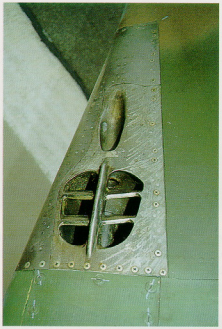
Upper intake lip is located some distance from the bottom fuselage and features some airflow guidance fairings between fuselage and intake roof.

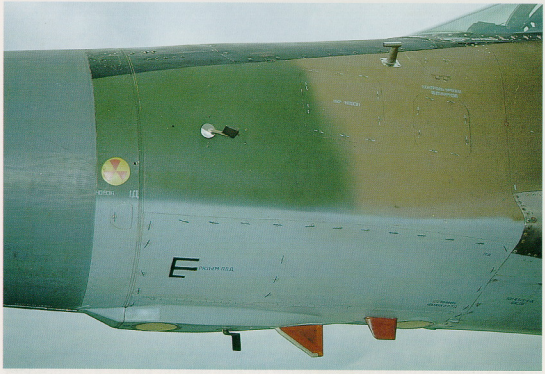


The gun compartment cover has a small inspection panel to the rear, also secured with fasteners. Soviet aircraft designers and staff members did not seem to care much for quick servicing of their fighters. Spent cases are ejected between the engine nacelles, eliminating cannon use when centerline fuel tank is installed.



The single-piece hinged canopy has three large rear view mirrors installed, covering the entire arc of the front framing. Four locking hooks can be seen in the bottom rail to fit openings in the cockpit sills.





Forward left side nose area with bare metal gun exhaust muzzle in the center of the picture. Just aft of the gun opening is a two-rib blast suppression duct shown in detail in the top left picture. On top are four vented slots to remove gun gases from the gun compartment.

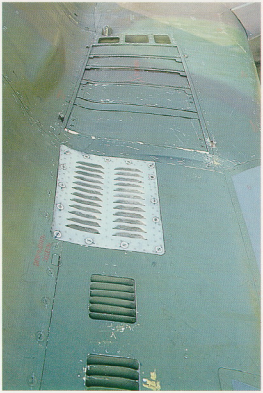
One more AOA vane and static sensor probe can be found on the left side nose area. Note the camouflage demarcation line.

Bottom fuselage detail just aft of the nose gear housing also showing the thick gear door to the right.

(Both top photos Jan-Toine van HOOFT)

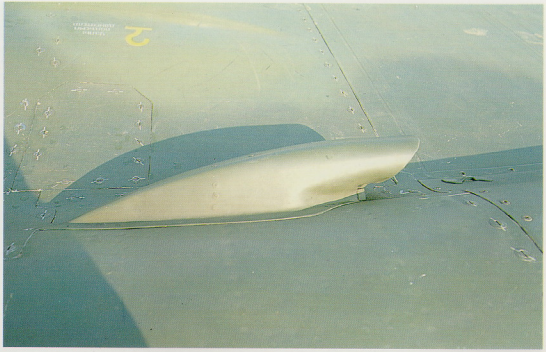
(Top right and below) When the intake FOD screen is lowered with engine cranked, the spring-loaded ventral auxiliary air intakes automatically open to maintain a constant airflow to the engines.

Soviet pilot stepping from the cockpit of his MIG-29C after a successful demo flight. Canopy shape is clear as well as the bulky spine featuring air intake scoop.

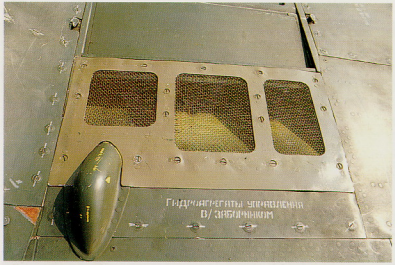


(Above & right) Halfway down the tunnel between the engine nacelles is an auxiliary power unit outlet door and exhaust vents. Centerline fuel tank connectors and hook-ups are also apparent.

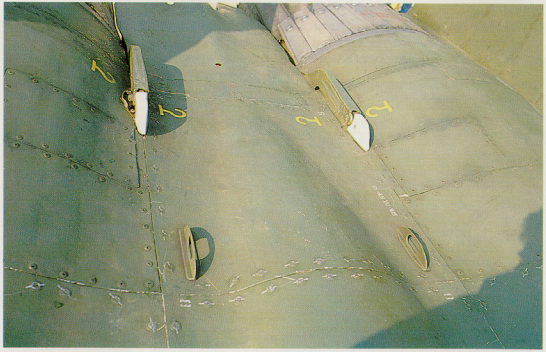
Upper fuselage detail includes small circular inspection glass in the slope of the spine, next to the right side auxiliary intake doors.
Note the rough texture of the skin surface.



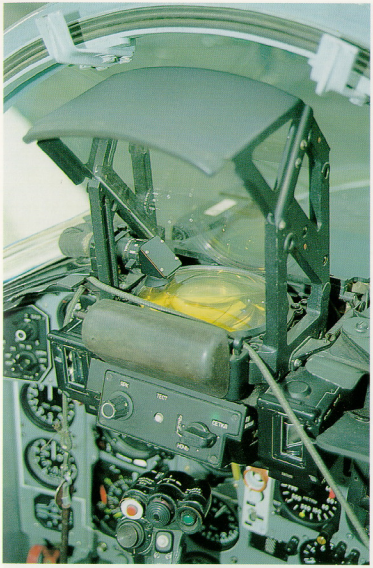
The APU air intake scoop mentioned earlier is located just on top of the GTDE-117 gas turbine auxiliary power unit. The APU is used not only to start the engines but for cranking cold engines during maintenance and to provide power for all systems during ground operations.

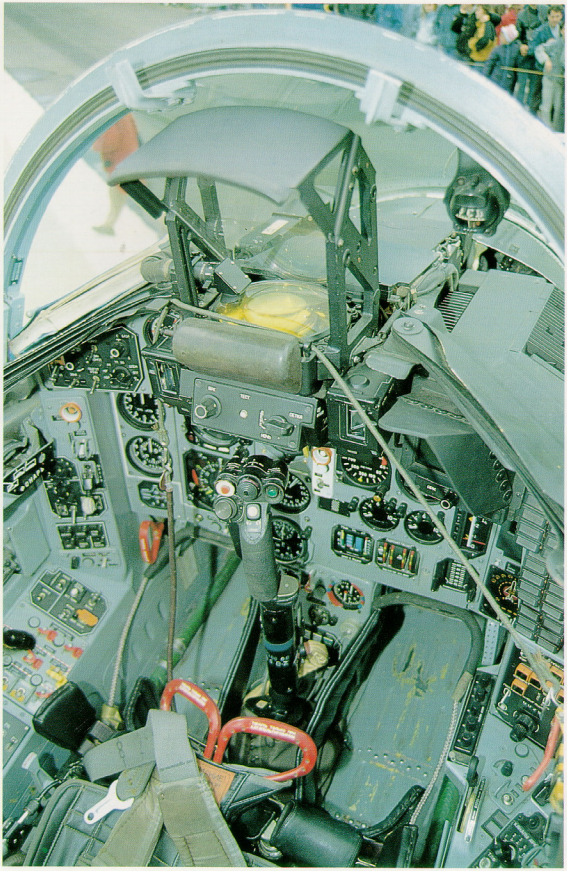


A screen cover spans the boundery layer bleed air vents aft of the auxiliary air intakes. Again note the cyrillic inscriptions.

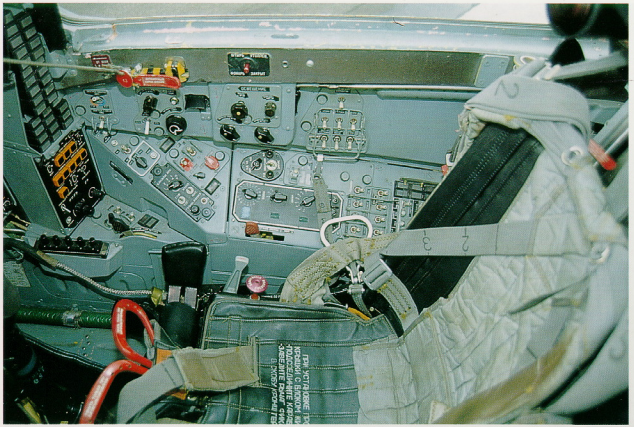


Speedbrake actuators which are located inside of each engine nacelle (above and below). Noteworthy is the tapering of the spine into the speed brake and the lifting eyes closest to the camera.

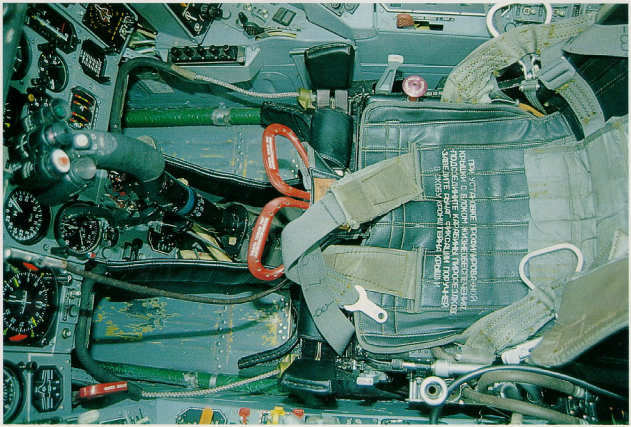




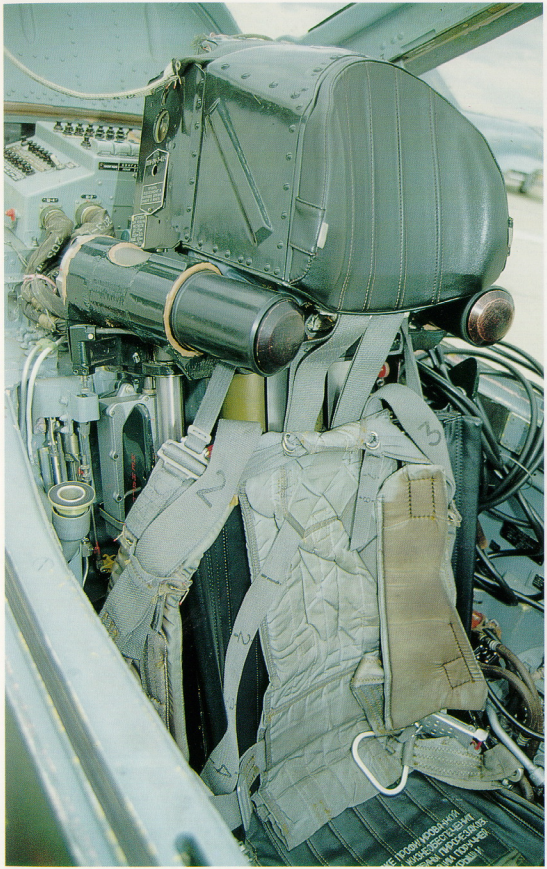
MIG-29A cockpit layout looks fairly up-to-date unless compared to that of newer western fighters such as the FA-18 Hornet which has more digital screens installed.
A simple (but large) HUD provides the pilot with useful flight data while the small screen to the right is the radar IRST scope.
Radar mode selector panel is located on the auxiliary instrument panel at left of the main instrument panel. The flight control system panel is located at the bottom of same.
Conventional flight instruments are at left on the main panel while engine related monitoring gauges are on the right.
Weapon selector panel can be seen at top left of the main panel.

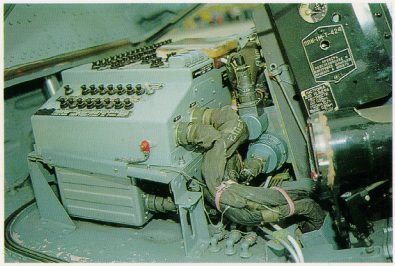


Right side console is very unlike western designs. Some of the control panels are sidewall-mounted such as (from front to rear) cabin temperature control panel, exterior lighting panel, instrument illumination control panel and finally electric circuits integration panel.
Forward side slope panels are RWR control panel, APK channel selector panel (black) and IFF control panel.
Rear side slope's main panel is the data link control panel with ARK compass (black) and engine starter panel also visible.

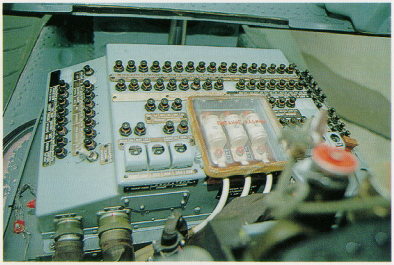


Looking down on the seat of the K-36DM zero-zero ejection seat with dual actuating handles painted bright red and the centrally located control column. The seat is effective up to 1300 km/h. After tightning the multi-strap combined harness, the pilot can increase the restraint by using a lever. Note the leg protectors on either side of the control column and the leg restraint cords.



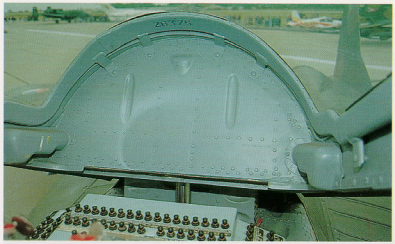


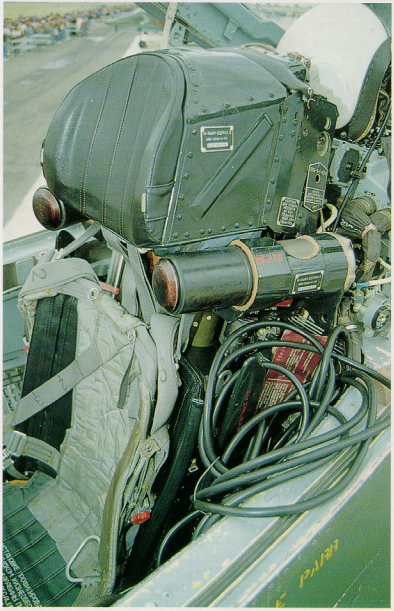
Behind the ejection seat headrest and still inside the pressurized area of the cockpit (note canopy seal) is mounted a circuit breaker box with related control boxes. These pushbuttons cannot be reached by the pilot when strapped in his seat harness but is likely to be operated by a ground crewmember. Note that various feed lines are "hosed" in groups.

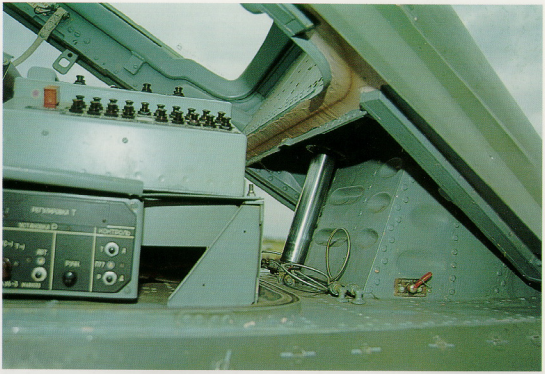


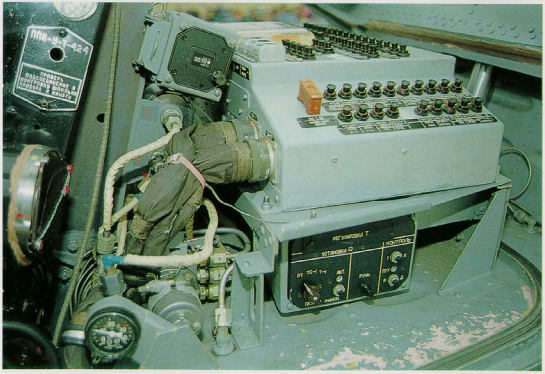
Box layout from above looking aft.

The K-36DM is rocket propelled and has two prominent telescopic stabilizing rods on either side of the headrest. Position of these cylinders is at least remarkable and is likely to limit pilot head movement during aerial combat. Note the shape and immense size of the headrest itself.

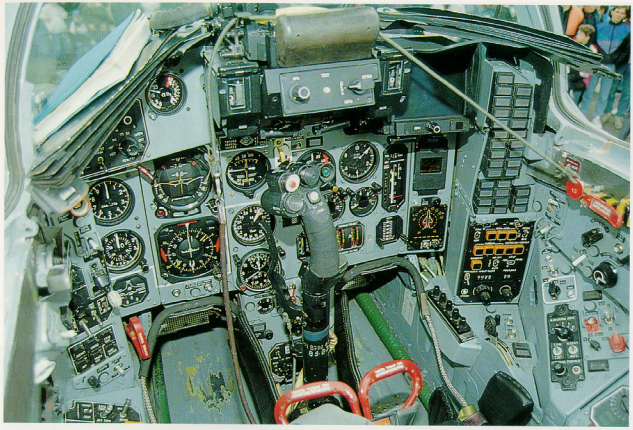




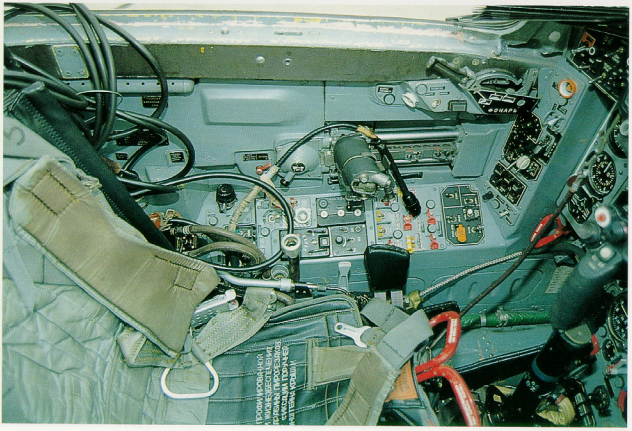




The same area viewed from the opposite side with a close look on the single canopy actuator rod aft of the circuit breaker box. The actuator is hydraulically operated.
The duct running along the inside of the canopy frame is part of the canopy defogging system and hooks up to the connector on the right side cockpit sill shown in the large picture on the previous page.



An overall view of the main instrument panel, clearly showing the right side with radar IRST scope on top. Right of it is the master warning panel with the navigation control panel immediately below.
Navigation, flight, electro-optical and radar attack modes as well as GCI information is grouped on the SEI-31 indicator system by its ORBITA-20 computer. Some 80% of the CRT data is projected on the combiner glass of the HUD.



Left side cockpit area with an unusual linear throttle assembly mounted to the sidewall instead of being located on the side console.
Panels on the side console are (from front to rear) armament control panel, fuel and engine control panel, radio compass panel, flap control panel (next to former), VHF panel next to APY and oxygen panel. Note that cable is not part of cockpit layout but is groundcrew related.

(Photo Jan-Toine van HOOFT)

Two shots showing bottom and top detail and camouflage of a VVS aircraft (bottom fuselage view) and a Czechoslovakian MIG-29 (upper fuselage view). Note auxiliary intake doors on top are open during high speed and high angle of attack maneuvering.

Typical eastblock MIG-29 fighter pilot helmet with single visor and outdated lowering mechanism. Note that no protection is at hand for the visor and the white, "easy-to-spot" overall color.

A usually misinterpreted component of the complex weapon system is the NSC helmet mounted sight as part of the OEPrNK-29E2 target acquisition system. This aiming system enables off-axis aiming (instead of through the HUD) while in air-to-air combat. To activate the system the pilot has to lower the optical gunsight (by helmet-mounted pushbutton). Three laser diodes on the helmet emit differently modulated beams (determining a plane). The receivers are two revolving prisms on either side of the HUD. They sense any change of position of the plane demodulating the beams. The straight determined by the right eye of the pilot and the small gunsight is perpendicular to the plane mentioned above. For aiming, the pilot has to point the straight to the target by turning his head. The KOLS and infra-red missile seekers follow this movement and as the pilot designates the target for the KOLS, the IR sensor tracks the target while the LR measures the range and computes velocity. Launch parameters are fed into the IR homing missiles which are then locked-on to the target. The pilot is informed when the system is ready to launch the automatically selected missile.

(Photo Jan-Toine van HOOFT)

MIG-29C with two external fuel tanks mounted on the inboard pylons and missiles on the remaining hardpoints. Note the maintenance platform on the steep sideslope of upper leading edge extension.

(Photo Nico DEBOECK)

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